

WHAT'S NEW IN CORN SILAGE?

HYBRIDS

QUALITY

FEEDING

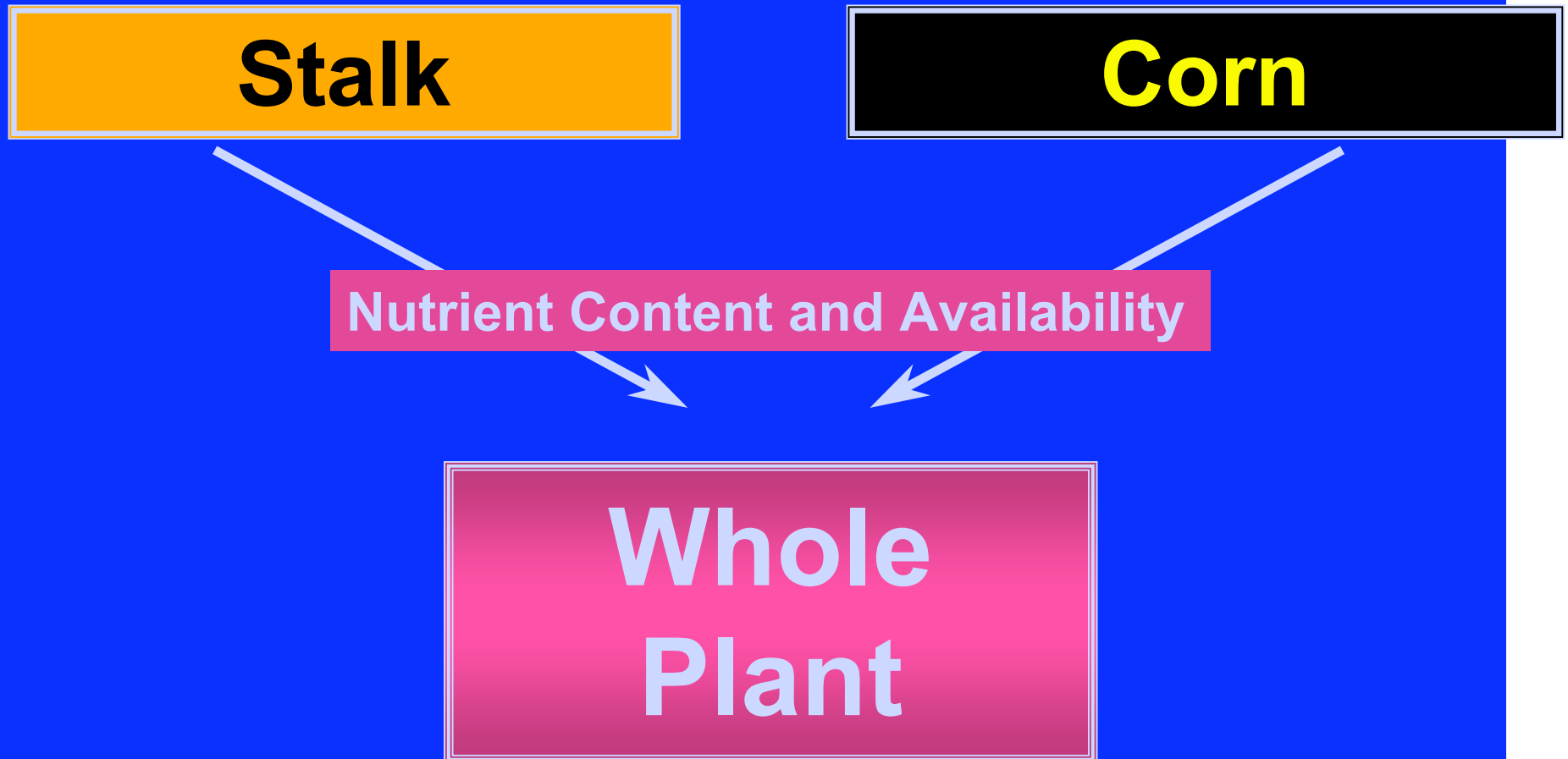
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Corn Silage in Minnesota

- **7.7 million tons harvested in 2002**
- **Average dairy cows eats 40 lb/day**
Range 0 to 70 lb/cow/day
- **Excellent source of energy (starch)**
- **Good source of fiber**

Corn Plant Challenges



CORN SILAGE HYBRIDS

- ⇒ **Brown Midrib**
- ⇒ **Leafy**
- ⇒ **High Lysine**
- ⇒ **High Oil**
- ⇒ **Waxy**

Brown Midrib Corn Silage

■ Beneficial traits

Reduced lignin - higher fiber digestibility

Brown Midrib Corn Silage

| Study | Control Corn Sil | Corn Sil % of DM | lb/d difference | |
|-------------|---------------------|---------------------|-----------------|-----------|
| | | | Milk | DM intake |
| MD -2001 | Iso | 60 | +6.8 | +5.3 |
| MI St -1999 | Iso | 45 | +6.1 | +4.6 |
| NY – 2001 | Conv | 31 | +4.8 | NR |
| MN – 2001 | Conv | 38 | +5.7 | +1.8 |
| WI – 2000 | Conv | 32 – 40 | -3.1 | 0 |

Leafy Corn Silage

■ Beneficial traits

More leaves above the ear

Improved fiber and DM digestibility

Increased yield per acre ?

Leafy Corn Silage

| Study | Control Corn Sil | Corn Sil % of DM | lb/d difference | |
|-----------|---------------------|---------------------|-----------------|-----------|
| | | | Milk | DM intake |
| MN - 1999 | Grain | 40 | -1.4 | -1.0 |
| MN - 2002 | Grain | 40 | -2.2 | +0.7 |
| NY - 2001 | Grain | 31 | -0.2 | NR |
| WI - 2002 | Grain | 42 | +3.1 | +2.0 |
| WI - 2000 | Grain | 33 | -0.5 | -1.3 |
| NY - 2001 | Dual P | 26 | +3.3 | -2.0 |
| OH - 2002 | Dual P | 45 | +1.6 | -0.5 |

High Lysine Corn Silage

■ Beneficial traits

Higher lysine content (.26 vs .4%) in grain DM
Higher starch and DM digestibility ?

■ Research results

| Beek and Dado | DMI | Milk | Fat |
|----------------|--------------------|-------|------|
| %-- | ----- lb/ day----- | ----- | -- |
| Reg CS - Reg G | 52.1 | 58.5 | 4.03 |
| Reg CS - HL G | 49.9 | 59.0 | 4.00 |
| HL CS - Reg G | 56.1* | 59.8 | 4.02 |
| HL CS - HL G | 55.4* | 59.4 | 3.91 |

High Oil Corn Silage

■ Beneficial traits

More oil in kernel

Normal 3.5 to 4%

Hi Oil >6.5% plus

■ Research results

| Study | DMI | Milk | Fat |
|---------------|-----------|----------|-------|
| Minnesota | ----- lb/ | day----- | --%-- |
| Control | 53.9 | 89.8 | 3.38 |
| Hi Oil | 59.0 | 90.4 | 3.55 |
| Control + fat | 53.7 | 88.2 | 3.61 |

Waxy Corn Silage

■ Beneficial traits

Softer kernel - more digestible?

■ Research results

Corn silage - None

Grain study - ND and MN (Crookston)

Cows fed waxy corn ate 3.6% more DM

No differences in milk production

(73 lb/day)

A close-up photograph of corn silage, showing a mixture of yellow corn kernels and finely chopped, fibrous plant material in shades of yellow and brown. The text is overlaid on this image.

Corn Silage Quality

THE CHALLENGE

**Identifying analyses which accurately
reflect feeding value**

Variation in Corn Silage Quality

AnalysisAverageRangeCP, %¹9.35.9

Factors Affecting the Feeding Value

- **Dry Matter (DM) or Moisture**
- **Starch form and digestibility**
- **Fiber content and digestibility**
- **Particle size (whole plant and kernel)**

Corn Silage Quality Maturity vs DM Content

| | DM content of Corn silage (%) | | | |
|----------|-------------------------------|------|------|--|
| Nutrient | 31.1 | 34.2 | 43.6 | |
| CP, % | 7.0 | 7.4 | 6.7 | |
| NDF, % | 43.9 | 41.2 | 43.7 | |
| NFC, % | 40.7 | 42.9 | 41.1 | |

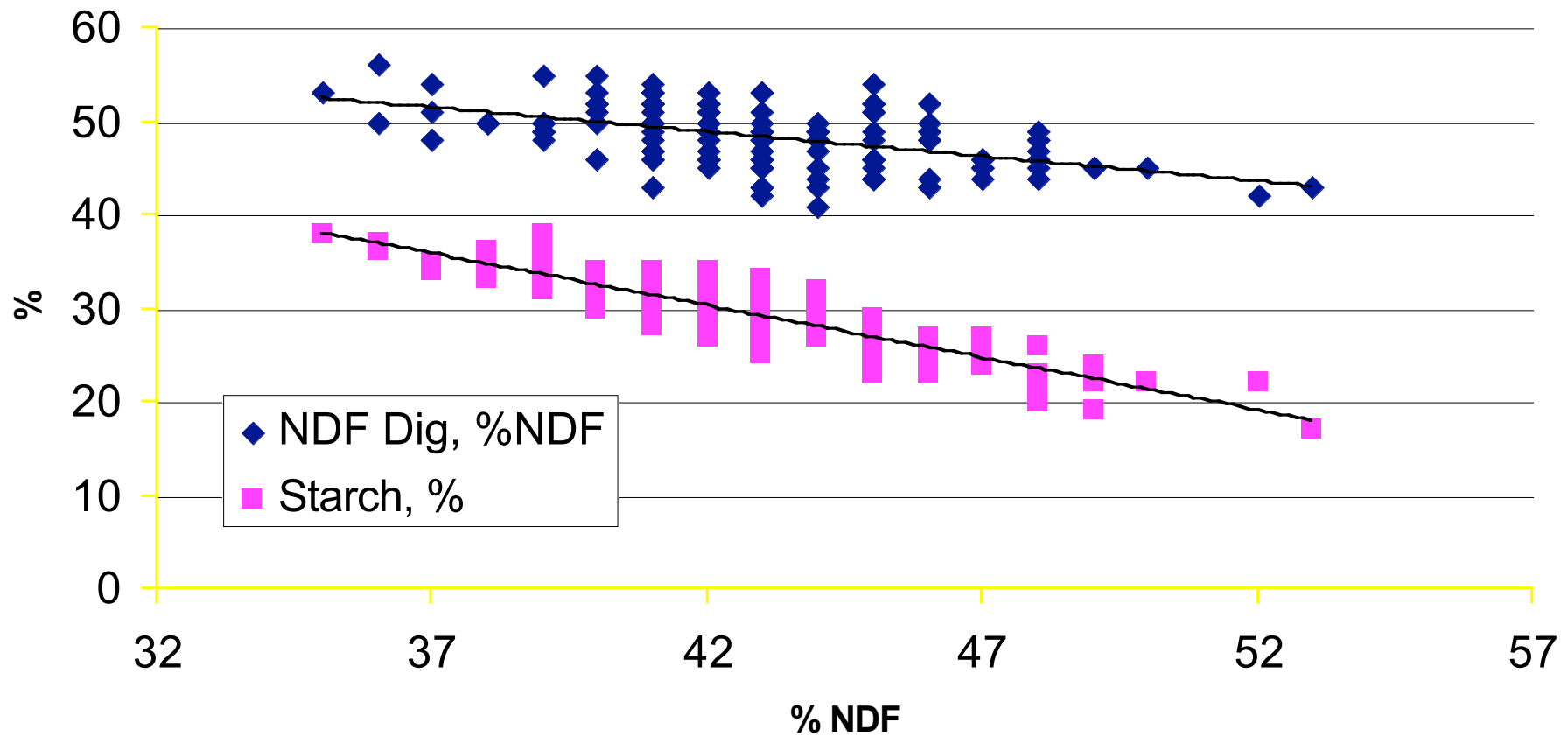
Normal growing year – normal maturing

Effect of DM on Nutrient Composition and Digestibility

DM, %30323542NDF, %52444041Starch, %

Corn Silage Trial - MN 2002

29 Hybrids - 4 Locations



Impact of Corn Silage NDF Digestibility on Milk

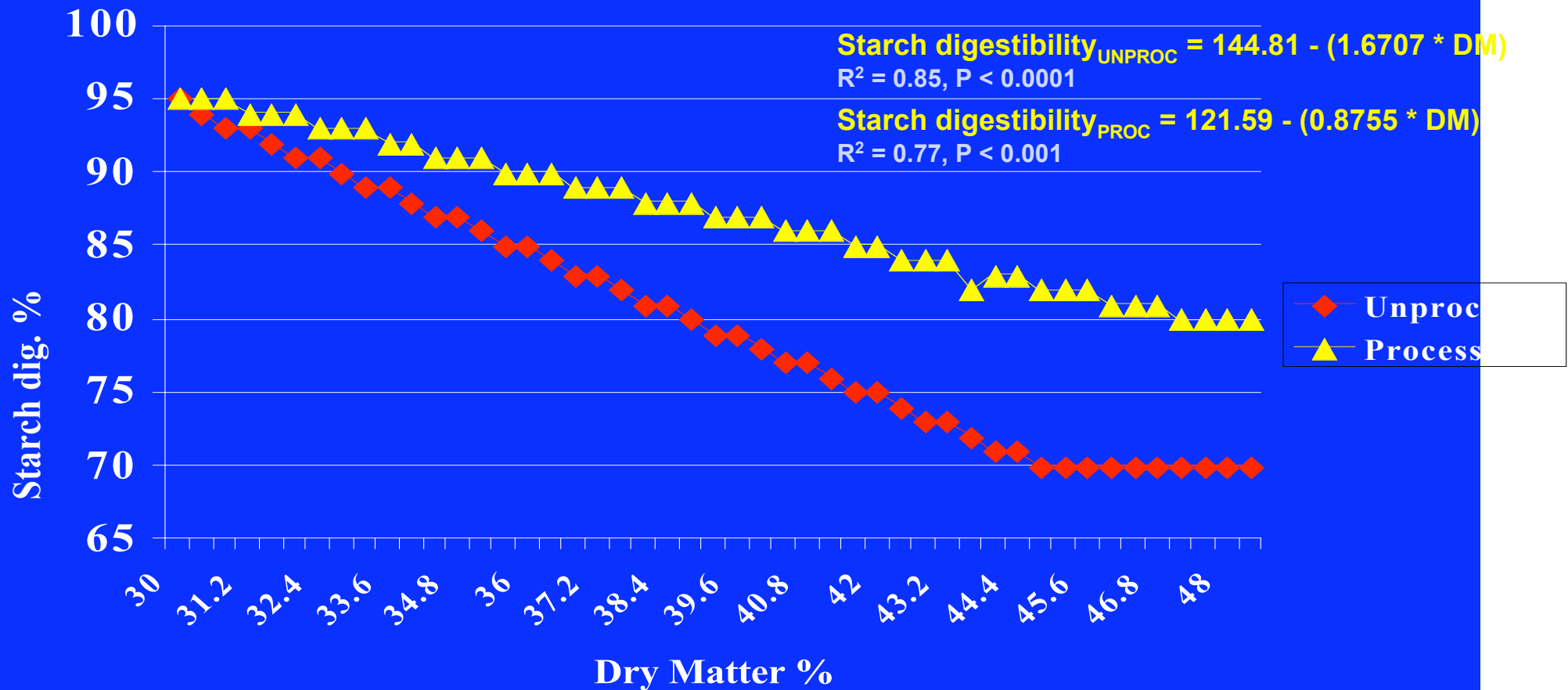
| <u>Item</u> | <u>45% NDFD</u> <u>lb DM/d</u> | <u>58% NDFD</u> <u>lb DM/d</u> |
|-------------------------------------|-----------------------------------|-----------------------------------|
| Alfalfa (45 % NDFD) | 10 | 10 |
| Corn Silage (45 vs 58% NDFD) | 23 | 23 |
| Corn | 10 | 10 |
| Cottonseed | 5 | 5 |
| Protein & Mineral | 7.4 | 7.4 |
| DMI | 55.4 | 55.4 |
| NE_L Milk, lb/day | 96.6 | 98.2 |
| MP milk, lb/day | 93.5 | 94.5 |

Corn Silage & Starch Digestibility?

Harvest Maturity

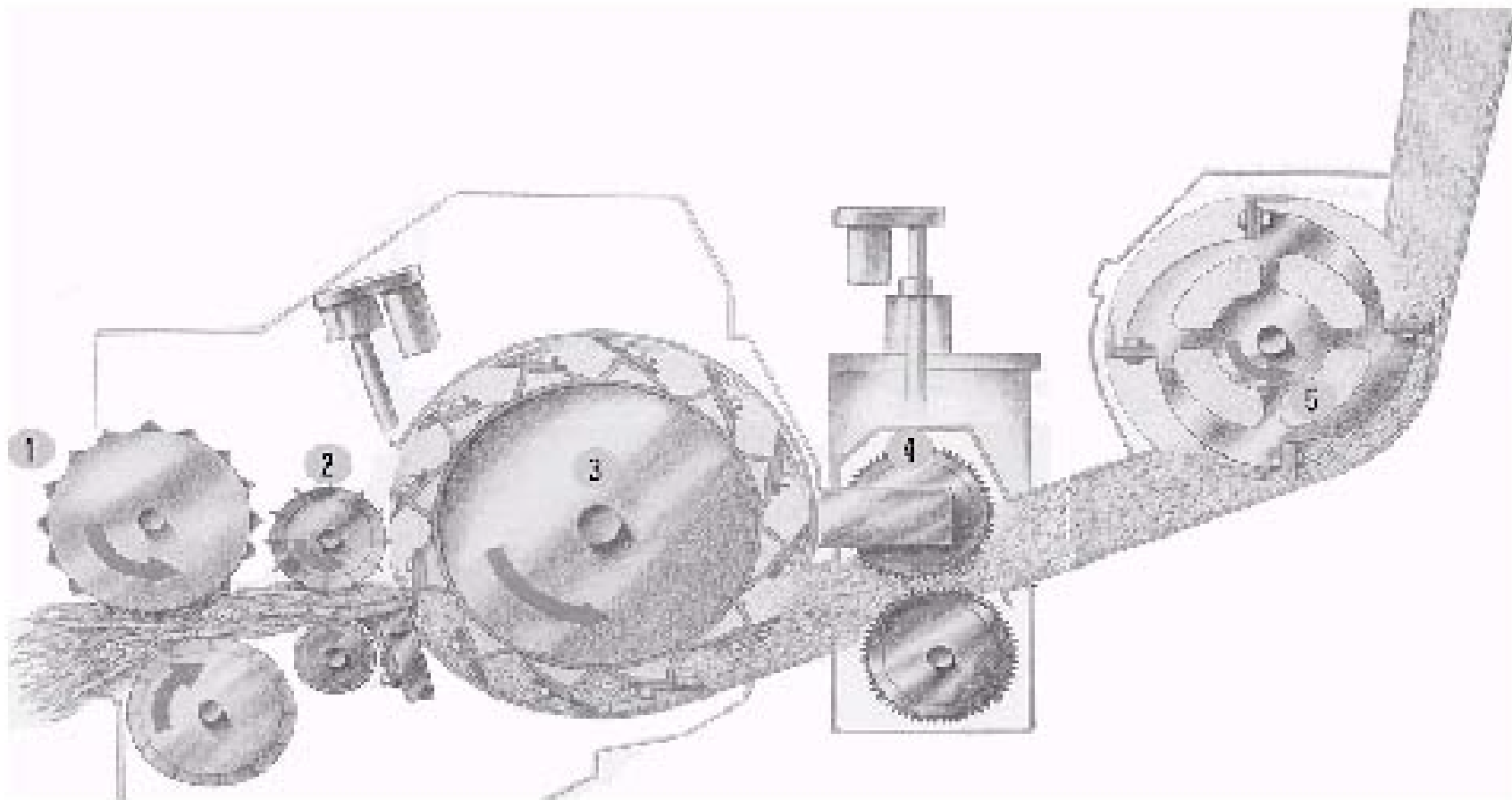


Predicted Total Tract Starch Digestibility Shaver, 2002



*Based on data of Bal et al., 2000; Dhiman et al., 2000; Rojas-Bourrillon et al.1987

Corn Silage Processing & Particle Size



Schematic of harvester with ① and ② feed rolls, ③ cutterhead, ④ crop processor and ⑤ blower.

Effect of Maturity on Corn Silage Particle Size

| | % DM | | | |
|---------------|------|------|------|--|
| Particle inch | 31.1 | 34.2 | 43.6 | |
| > 3/4 | 8.9 | 10.0 | 10.0 | |
| 1/3 – 3/4 | 61.8 | 59.8 | 55.1 | |
| < 1/3 | 29.3 | 30.2 | 34.9 | |

Effect of Corn Silage Particle Size on DM Intake and Eating

| | Short | Med Short | Med Long | Long |
|------------------------|-------------|--------------|-------------|-------------|
| TMR | | | | |
| Top % | 2.9 | 6.7 | 11.1 | 15.5 |
| Middle % | 92.8 | 89.5 | 85.0 | 80.6 |
| Bottom % | 4.2 | 4.0 | 3.9 | 3.9 |
| TMR – DMI, lb/d | 61.7 | 59.1 | 59.1 | 56.6 |
| Milk – lb/d | 91.0 | 93.3 | 91.5 | 90.6 |

TMR – 57% corn silage

Kononoff et al. 2003

Corn Silage Particle Size on Milk Production

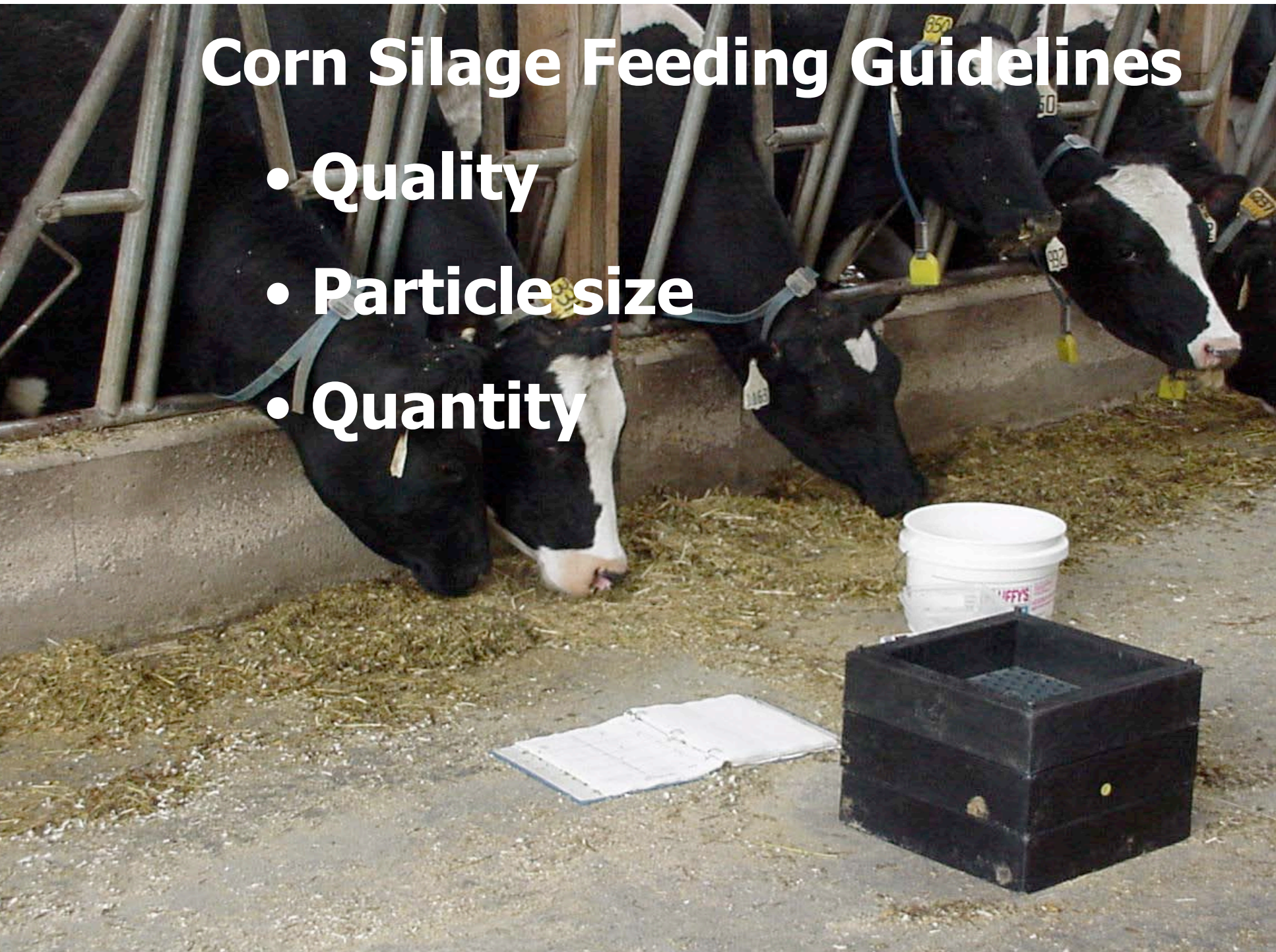
| Corn Sil | Short | Long |
|---------------|-------|------|
| > 3/4, % | 28.8 | 34.4 |
| 1/4 to 3/4, % | 34.0 | 25.3 |
| < 1/4, % | 37.2 | 40.2 |
| DMI, lb/d | 56.6 | 55.1 |
| Milk, lb/d | 91.9 | 90.4 |

TMR – 50% corn silage

Onetti et al. 2003 (WI)

Corn Silage Feeding Guidelines

- Quality
- Particle size
- Quantity



Corn Silage Quality Today

Where Are We?

Hybrid differences

Environment – wet to drought

Fiber (NDF) and Starch

Quantity

Digestibility

ANALYSIS REQUIRED

Minimum concentrations of total and forage NDF and maximum concentrations of NFC (% of DM)

| Min Forage NDF | Min Total NDF | Max NFC | Min ADF |
|----------------|---------------|---------|---------|
| 19 | 25 | 44 | 17 |
| 18 | 27 | 42 | 18 |
| 17 | 29 | 40 | 19 |
| 16 | 31 | 38 | 20 |
| 15 | 33 | 36 | 21 |

¹Values in this table are based on the assumption that actual feed composition has been measured .

Based on data where TMR fed and dry ground corn was starch source.

Particle Size Influences Feeding Value

Penn State Box Guidelines – Corn Silage

Top < 10%

Middle > 60%

Bottom < 30%

Processed and Unprocessed



Corn Silage Feeding Guidelines

■ Quantity in lactation diets

- Range = 0 to 100% of forage DM
- Optimum – 50 to 75% of forage DM

■ NDF Guidelines (CS > 65% of forage)

- Total NDF in diet – 30 to 34% of DM
- Forage NDF – 22 to 25% of diet DM

■ Guidelines vary with quality and hybrid

**REMEMBER
FORAGE
QUALITY
PAYS**



**THANK
YOU**